WHAT IS CLAIMED IS:

1. A photomask designing method used in a lithography process, the lithography process comprising illuminating light on a photomask and converging the light which has passed through the photomask on a photosensitive substrate via a projection optical system, the photomask designing method comprising:

acquiring a transmittance characteristic of the projection optical system, the characteristic varing depending on a difference in optical paths of light in the projection optical system, the light passing through the projection optical system, and

acquiring mask bias of the photomask by use of the transmittance characteristic of the projection optical system.

2. The designing method according to claim 1, wherein the acquiring the transmittance characteristic of the projection optical system comprises acquiring a transmission factor of the projection optical system for diffraction light which is generated on the photomask and passes through the projection optical system.

3. The designing method according to claim 1, wherein the photomask comprises a plurality of patterns having different shapes respectively and the acquiring the mask bias of the photomask comprises acquiring a plurality of mask biases for the plurality of patterns.

4. The designing method according to claim 2, wherein the photomask comprises a plurality of patterns having different shapes respectively and the acquiring the mask bias of the photomask comprises acquiring a plurality of mask biases for the plurality of patterns.

5. The designing method according to claim 1, wherein the acquiring the transmittance characteristic of the projection optical system comprises acquiring transmission factors of the projection optical system for diffraction lights which are generated on a plurality of regions of the photomask and the acquiring the mask bias of the photomask comprises respectively acquiring mask biases for the plurality of regions of the photomask.

6. The designing method according to claim 1, wherein the acquiring the transmittance characteristic of the projection optical system comprises acquiring transmission factors of the projection optical system for diffraction lights which are generated on a plurality of regions of the photomask and the acquiring the mask bias of the photomask comprises acquiring common mask bias for the plurality of regions of the photomask.

7. A pattern predicting method for predicting a pattern to be formed on a photosensitive substrate, the pattern being formed by illuminating light on a photomask and converging the light which has passed

through the photomask on the photosensitive substrate via a projection optical system, the pattern predicting method comprising:

approximating a transmission factor variation of the projection optical system by use of an orthogonal polynomial defined by pupil coordinates of the projection optical system, the transmission factor varing depending on a difference in optical paths of light in the projection optical system, the light passing through the projection optical system, and

predicting the pattern based on expansion coefficients of the orthogonal polynomial, the expansion coefficients approximating the transmission factor variation of the projection optical system.

8. The pattern predicting method according to claim 7, wherein the orthogonal polynomial is a Zernike polynomial.

9. The pattern predicting method according to claim 7, wherein the photosensitive substrate is a substrate on which a resist is coated and the pattern is an optical image of a pattern of the photomask projected on the resist or a resist pattern obtained by developing a resist on which an optical image of a pattern of the photomask is projected.

10. The pattern predicting method according to claim 8, wherein the photosensitive substrate is a substrate on which a resist is coated and the pattern

is an optical image of a pattern of the photomask projected on the resist or a resist pattern obtained by developing a resist on which an optical image of a pattern of the photomask is projected.

11. A photomask designing method used in a lithography process, the lithography process comprising illuminating light on a photomask and converging the light which passes through the photomask on a photosensitive substrate via a projection optical system, the photomask designing method comprising:

approximating a transmission factor variation of the projection optical system by use of an orthogonal polynomial defined by pupil coordinates of the projection optical system, the transmission factor varing depending on a difference in optical paths of light in the projection optical system, the light passing through the projection optical system,

predicting a pattern formed by converging the light having passed through the photomask on the photosensitive substrate via the projection optical system based on expansion coefficients of the orthogonal polynomial, the expansion coefficients approximating the transmission factor variation of the projection optical system,

determining whether a difference between the predicted pattern and a designed pattern corresponding to the photomask lies within a predetermined range or

not, and

correcting the photomask to set the difference between the predicted pattern and the designed pattern into the predetermined range when the difference does not lie within the preset range.

12. The designing method according to claim 11, wherein the orthogonal polynomial is a Zernike polynomial.

13. The designing method according to claim 11, wherein the photosensitive substrate is a substrate on which a resist is coated and the pattern is an optical image of a pattern of the photomask projected on the resist or a resist pattern obtained by developing a resist on which an optical image of a pattern of the photomask is projected.

14. The designing method according to claim 12, wherein the photosensitive substrate is a substrate on which a resist is coated and the pattern is an optical image of a pattern of the photomask projected on the resist or a resist pattern obtained by developing a resist on which an optical image of a pattern of the photomask is projected.

15. A computer program product configured to store program instructions for execution on a computer system enabling the computer system to perform a process for predicting a pattern to be formed on a photosensitive substrate, the pattern being formed by illuminating

light on a photomask and converging the light which has passed through the photomask on the photosensitive substrate via a projection optical system, wherein the predicting the pattern comprising:

approximating a transmission factor variation of the projection optical system by use of an orthogonal polynomial defined by pupil coordinates of the projection optical system, the transmission factor variation varing depending on a difference in optical paths of light in the projection optical system, the light passing through the projection optical system; and

predicting the pattern based on expansion coefficients of the orthogonal polynomial, the expansion coefficients approximating the transmission factor variation of the projection optical system.

16. The computer program product according to claim 15, wherein the orthogonal polynomial is a Zernike polynomial.

17. The computer program product according to claim 15, wherein the photosensitive substrate is a substrate on which a resist is coated and the pattern is a resist pattern obtained by developing a resist on which an optical image of a pattern of the photomask is projected or an optical image of a pattern of the photomask projected on the resist.

18. A computer program product configured to store

program instructions for execution on a computer system enabling the computer system to perform a process for designing a photomask used for a lithography process, the lithography process including illuminating light on the photomask and converging the light having passed through the photomask via the projection optical system, wherein the designing the photomask comprising:

approximating a transmission factor variation of the projection optical system by pupil coordinates of the projection optical system, the transmission factor varing depending on a difference in optical paths of light in the projection optical system, the light passing through the projection optical system,

predicting a pattern formed by converging the light having passed through the photomask on the photosensitive substrate via the projection optical system based on expansion coefficients of the orthogonal polynomial, the expansion coefficients approximating the transmission factor variation of the projection optical system,

determining whether a difference between the predicted pattern and a designed pattern corresponding to the photomask lies within a predetermined range or not, and

correcting the photomask to set the difference between the predicted pattern and the designed pattern into the predetermined range when the difference does

not lie within the preset range.

19. The computer program product according to claim 18, wherein the orthogonal polynomial is a Zernike polynomial.

20. The computer program product according to claim 18, wherein the photosensitive substrate is a substrate on which a resist is coated and the pattern is an optical image of a pattern of the photomask projected on the resist or a resist pattern obtained by developing a resist on which an optical image of a pattern of the photomask is projected.